

densing the manifold discoveries of recent years into small compass without sacrifice of accuracy. But he would have produced a more readable, and, we think, more effective book, had he ruthlessly cut out half his information, and expanded the other half so as to supply a series of more carefully graded explanations. A youth who has already made a hobby of electrical-instrument making or who has studied the subject successfully at school might read "Electricity for Young People" with interest, and in that case he would certainly read it with profit.

(4) In the fourth volume of the series, Mr. Jenks had an easier task, since "Photography for Young People" appeals directly to a favourite pursuit. There is a good chance of success for any book of moderate price which tells a boy with sufficient clearness the methods by which he can succeed in his hobby. In this book the young photographer will find good practical instructions, and a particularly clear exposition of the principles of the art he is striving to master. The author is at home alike when dealing with the beginnings of photography and when putting the latest discoveries within reach of the young amateur. Technical terms are properly treated, *i.e.* they are not evaded, but used after explanations have been given in simple language. The acquisition of such terms is enjoyed by a boy, and is good for him provided they are made to become part of his mental possessions—tools in his mental workshop. In each of these volumes a very fair standard is reached as regards illustrations, print, and binding. A plea may be urged for yet more copious illustrations in such books, as the youthful reader is greatly helped thereby. Both (3) and (4) are well indexed.

G. F. D.

PHYSICAL ACOUSTICS.

(1) *A Text-book of Sound.* By Prof. E. H. Barton. Pp. xvi+687; illustrations. (London: Macmillan and Co., Ltd., 1908.) Price 10s. net.

(2) *Traité de Physique.* By O. D. Chwolson. Translated by E. Davaux. Tome i., fascicule iv. Acoustique. Pp. vii+873-1092. (Paris: A. Hermann, 1908.) Price 8 francs.

(1) **P**ROBABLY no branch of physics is so poorly represented by text-books as that of sound. Between very elementary volumes and Lord Rayleigh's masterly treatise very little exists. The former are too trivial, while the latter is far too severe for the first or second year senior undergraduate. For this reason, amongst others, the present volume will be received gladly by both teacher and student, for it very adequately fills the gap in our expository literature.

What, then, are the main characteristics of this book which confer superiority upon it? In the first place, the author does not hesitate to employ the elements of the calculus, although in many cases geometrical proofs are given as well. We think the day is now gone in which it was supposed that a student's undergraduate work could be carried on without reference to the calculus. We know that university regulations have in some cases encouraged this belief; but teachers have for a long time ignored

these restrictions and have freely employed the calculus in their demonstrations. We hope that the time may come when mathematicians will see their way to give an adequate introduction to such methods in the first collegiate year. It is possible that some matters which are dear to them will need to be postponed until later in order that this may be done. The attempt is made, and satisfactorily so, in some schools; we hope that this practice will become universal. It is true that in some cases an exceedingly quick and convincing proof of a theorem can be obtained by geometrical methods; but, on the other hand, the present writer could lay his finger on pages of proof, partly algebraic, partly graphical, which could all be condensed into a few lines, and which have caused endless bother to the students with whom he has come in contact. Even in the book before us the graphical parts are not those which are clearest, though we have nothing but praise for the thorough way in which those parts are dealt with.

The second main characteristic is the close connection, maintained throughout, between theory and experiment. A treatise on sound is bound to be somewhat mathematical; but the author never misses a chance of introducing an experimental illustration or an account of some experimental verification of a theorem proved.

After a short preliminary survey the book continues with a somewhat long mathematical account of the kinematical and dynamical bases of the subject (including a chapter on elasticity). It is, perhaps, in this part that a curtailment might have been made. The elastic properties of bodies are now usually considered under the head of properties of matter. (By the way, is not the method for calculating the velocity of sound in a gas which starts by superposing an equal but opposite velocity due to Rankine? The author seems to imply that it is Rayleigh's method.) We regret that the part devoted both to the theoretical and experimental side of diffraction should be so short. Dr. Barton probably considers that this should be left to be treated in a text-book on light.

In the third place, we commend this book because it rings true to the spirit of research. The author has himself contributed in some degree to our knowledge of the subject, and he is abreast of the most recent work that has been done in connection with it. This is very notably the case in the large section which deals with musical instruments. Dr. Barton is specially qualified to deal with this side of the subject. The result is that we find here a compendium on the physical side of the qualities of musical instruments such as we believe cannot be found elsewhere.

Of recent work considered, mention may be made of Lord Rayleigh's work on the perception of sound direction, recent considerations in connection with the pressure of radiation, modern work on combination tones (no mention is made, however, of Barrett and Bolas's work on this subject), and the work of Sabine and of Marage on architectural acoustics. The last item is one in connection with which very little is definitely known, and to which research might very well be directed.

Dr. Barton has copied Lord Rayleigh in concluding with a section on electrical oscillations. We have never quite understood why this subject should be treated so fully in a text-book on sound. Some knowledge is, of course, needed in connection with the electrical maintenance of vibrations; but the knowledge so required is very much more than supplied by the theorems given here.

There are twenty-three pages of questions at the end. There are very few misprints in the entire book. We notice *modulus* spelt wrongly twice on p. 131, and we believe that it is to W. König, not A. König, that the explanation of the striated appearance of the dust in a Kundt's tube should be attributed.

(2) The second book which heads this review is a French translation of a Russian text-book. The German translation of the same portion was reviewed by us some time ago, and consequently a very brief notice will now suffice. To the present translation there is a preface by Amagat, and to the eulogistic remarks which he makes on Chwolson's treatise we would add that we consider the entire text-book to be the most satisfactory and complete of any with which we have met. The present part is, perhaps, not the most striking in its superiority; that praise must be reserved for the volume on heat and thermodynamics; but the critical judgment which Chwolson everywhere exhibits has enabled him to deal with the subject of sound in a very masterly way.

OUR BOOK SHELF.

The Zonal-belt Hypothesis. A New Explanation of the Cause of the Ice Ages. By Joseph T. Wheeler. Pp. 402. (Philadelphia and London: J. B. Lippincott Co., 1908.) Price 2.50 dollars net.

THE author of this book has read widely, and the latter two-thirds of it, dealing with comparative mythology, may be useful on account of the quotations. The first third is, as Mr. Wheeler shows in his historical introduction, a development of an idea suggested by Tyndall and by several later authors, to the effect that a thin "canopy" of a gas, capable of transmitting the luminous heat of the sun, but impervious to the dark heat-rays radiated back from the earth, might have a profound effect on the general climate. Such canopies may have arisen from time to time through the fall of rings of matter external to the atmosphere.

The author prefers to regard these rings as planetesimal in origin, and the new point introduced by him is the possibility that the canopies were resolved into belts, thus permitting of strong climatic zones. It is presumed that each ring, as it approached the earth, would divide and spread away as canopies towards both poles, where the centrifugal force was least. Such a time would be a generally warm one, with the production of clouds from evaporated water. These clouds would occur in high levels of the atmosphere, and would assist the rise of temperature. As the canopy aged and became unstable at its edges, it moved back towards the equator, leaving "natural sun-controlled climatic conditions," i.e. colder ones, in its wake (p. 103). The regions under the canopy would remain cloudy and warm. Condensation now took place in "the middle ground between the pole and the canopy belt." Here we have all that is needed for the production of a glacial period. Fluctuations in

the position of the edges of the canopy would account for interglacial episodes. The final breaking up of the planetesimal belt, and the disappearance of the accompanying atmospheric cloud-belt, caused the glaciation to invade the whole earth (p. 114). Primitive man saw the latest cloud-belts, which originated the myths of serpents twined about the earth.

The gases or planetesimal materials of each original belt are held to have been ultimately deposited as cosmic dust over the globe, after the manner of Mr. H. L. Fairchild's primitive "cosmoclastics" (p. 44). "As a canopy fell a geological age ended, and with it its life conditions" (p. 52). A large number of facts are called in to support the hypothesis, and even the size of Carboniferous insects is said to be an indication of a denser atmosphere. When it is suggested (p. 45) that the earth that has accumulated round the ruins of Nippur "may be in part the wind-blown remnants of cosmical world chaff," we feel inclined to appeal to geology rather than speculation; and it is with this feeling that we lay down the volume. One of the best things in the unfolding of Mr. Wheeler's hypothesis is the prominence given to the idea that tropical heat is quite compatible with an atmosphere of cloudy darkness.

G. A. J. C.

A Monograph of the British Desmidiaceae. By W. West and Dr. G. S. West. Vol. iii. Pp. xv+274; 31 plates (lxv.-xcv., of which 14 coloured). Sixty-fifth year of issue. (London: Printed for the Ray Society, 1908.) Price 25s. net.

IN notices of the earlier volumes we have had occasion to speak very highly of this work, which deservedly takes a front rank among monographs devoted to a single family of plants. The merits so conspicuous in these volumes are equally so in this, which is devoted entirely to a part of the great genus *Cosmarium*. Beginning with species 51, the text closes with species 224; but seven additional species are figured, although exigencies of space require their descriptions to be held over to vol. iv. A very large number of the species have named forms or varieties under them. A considerable proportion of these, and a few of the species, are new to science. The references to the literature under each already known species and variety are very ample. In discussing the distribution of each, the authors are careful to acknowledge the work of others, the names of Roy and Bissett occurring very frequently, and Archer, Cooke, Ralf, and Wills on many pages; but the larger part of the whole is the result of the very extensive researches among fresh-water algæ carried out by the authors themselves in many parts of the British Islands. The distribution beyond our islands is also given, and for some species is extraordinarily wide, e.g. *C. venustum* extends over the northern hemisphere, and has also been found in Java, Australia, and Paraguay, and several others are also dispersed in the fresh waters of almost every part of the world where desmids have been sought for. Under most of the species important notes direct attention to the more distinctive characters, the relations to allied forms, whether British or from other countries, peculiarities of habitat, and other characteristics that cannot be introduced into a systematic description, but which are often exceedingly helpful.

Every species and almost every variety and "form" are figured in the plates, wherever possible in positions to show the forms and markings or sculpture from the different aspects required to give a true conception of these characters. The details of the cell-wall are always shown in uncoloured, and usually the appearance of the living cells in coloured figures, all alike being the work of Dr. G. S. West.